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Science and Art Gossip.

IT seems likely that the lectures to be given by Mr. Proctor, at the St. James's Hall, will pave the way to the introduction of an annual series of KNOWLEDGE LECTURES, to be given by contributors to these pages, and others who are interested in the extension of knowledge.

SEVERAL country correspondents write to ask whether full reports of the lectures on astronomy in St. James's Hall will be given in these pages. We cannot do this. A popular lecture on astronomy (unless it forms part of a course of systematic instruction) is itself an epitome, and cannot, therefore, be effectively or usefully epitomised. I have seen reports of my lectures in almost every journal in America and Australasia (not counting, of course, purely local papers at places which I have not visited). I have never yet seen one report, claiming to be more than the merest abstract, which I should have cared to endorse as calculated to be a correct idea of the lecture.

IT is likely, however, that the lectures, or some of them, will hereafter be delivered, with such changes as the progress of discovery may render necessary, in many of the towns and cities from which communications have reached me.

I MAY make a slight correction of the very pleasantly-written biographical sketch accompanying my cartoon in last week's *Vanity Fair*. I wrote my first book—in fact my first three—*before*, not after, the loss of my property in the Overend and Gurney smash. This occurred in May, 1866, and my first book was published in 1865. It was not my book on the "Geometry of Cycloids" (which was written in time abstracted, somewhat uncomfortably, from more profitable labour, when I was in full swing of work), but "Saturn and its System," written between March, 1864, and May, 1865. But the moral was the same. Published in 1865, Saturn only reached a second edition last year. Books which have cost me a hundredth part of the work have reached their second thousand in a week.

MISS A. B. EDWARDS calls attention elsewhere to a most interesting discovery which has rewarded the very first efforts of the Egyptian Exploration Committee. Even the numerous correspondents who have been careful to assert their utter indifference to the doings of the Israelites in Egypt (as a religious matter), should recognise the interest which every thinking mind should take in one of the most ancient fragments of historical literature. The intercourse between the ancient Israelites and the Egyptians throws light on some of the most curious questions relating to the origin of both the Jewish and Christian religions. In a few days, for instance, the Jewish world and the Christian world (in the West at least) will be observing what is the festival of Easter to the latter, to the former the Passover of the Lord.

IF the ancient Egyptian religion had survived to this day, another portion of the human race would at the same time have been engaged in observing the Sun God's Passover, the festival associated with the ascending passage of the sun across the celestial equator. This is now only an astronomical observance, as is the descending passage which the Jewish world celebrates (though its origin is not mentioned in their religious books) in the Feast of Tabernacles. The region where the Israelites were held in bondage by the Egyptians is, probably, of all places, that which will best reward the labour of exploration. The first fruits of such exploration—the identification of Pithom-Succoth—is one of the most important discoveries (of its kind) of our time.

WE would, however, especially note how Miss Edwards has hastened to communicate this result to the world, though the discovery does not agree with the theory she has so ably advocated in these columns. This is the true scientific spirit. The service she has rendered to science in thus setting us all a worthy example, is even greater than that which any scientific research can render in itself. Be it noted, however, that the facts Miss Edwards has brought together in these columns are not a whit less valuable that one of the theories she based on them has failed.

MANY correspondents write to rebuke me for characterising as "bosh" the prediction of a tremendous storm on March 11. Some really believe that the prediction is based on real evidence. Others say, that as I cannot be sure there may not be a very severe storm on that day, I am exposing science to the risk of seeming to have made a great mistake. On this last point I am perfectly indifferent. If there should chance to be a most tremendous storm, as widespread and destructive as the prediction threatened, on Sunday, March 11, and thousands and millions should think science had merely blundered in rejecting the prediction as valueless, so much the worse for the thousands or millions. Science cannot predict storms on a particular day several weeks ahead, but science knows that those who make such predictions are either great knaves or very ignorant, either fools or charlatans. (There is nothing, however, to prevent their being both knaves and fools, if that third course will please them.) If I cared to guess, I should say that most probably there will be very rough weather—as usual—somewhere in our northern seas on March 11th, and that in whatever degree the storms may fall short of the threatened far-extending hurricanes, the prophets will be satisfied, and proudly proclaim, We told you so!

THE Squirrel Problem (p. 91) troubles many. The true answer is, of course, that the man *has* been round the

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squirrel, no matter what antics the creature may have played, without leaving the post round which the man has moved. The man would none the less have gone round the squirrel if he (the man) had kept his face always in one direction—say due east—during his circuit. The puzzle is only a verbal one. There is a colloquial sense in which the man may be said not to have gone all round the squirrel, so as to see the squirrel from all sides; he has gone all round it, but the conduct of the squirrel has deprived him of the satisfaction of having more than a front view of it.

Lord Walsingham is moved because the proposed bill against pigeon shooting threatens to put an end to many of our old English sports—since vertebrate animals kept in captivity, whether they be wild or domestic, are included. So that the fine old sport of stag-hunting, the coursing of trapped hares, and even the cheerful amusement of rat-killing, may expose those who take part in them to punishment. Bull-baiting, alas! has long since passed away from us, so that the pretty breed of dogs employed in that sport have now only a fancy value; cock-fighting is illegal, though it is still practised; and that noble old sport, prize-fighting, has, to all intents and purposes, come to an end. But shall sentimental legislation destroy the grand old sports which still remain to us? shall our braves cease to slaughter the fear-inspiring pigeon; shall they no longer learn pluck and dogged endurance by watching gallant coursing matches in pursuit of the ferocious hare? shall the buck (so fierce that he has to be carted for safety) be no longer pursued? and finally, shall the terrier no longer face the terrible rat? Perish the thought that these brave amusements of our great nation should be brought to an end by sentimental legislation!

At a recent meeting of the Académie des Sciences, the secretary reported that M. Mauser had succeeded in transmitting a message through a hundred telephone wires to as many destinations at once.

From statistics recently published on the production of Bessemer steel, it appears that Great Britain has, at present, twenty-three works, with a productive capacity of 1,460,000 tons per annum; Belgium has four works, with a productive capacity of 380,000 tons; Austria, fourteen works, 632,000 tons; Germany, twenty-three works, 1,300,000 tons; Russia, five works, 100,000 tons; Sweden, 80,000 tons; the United States, 1,500,000 tons.

The report of the Crystal Palace District Gas Company shows that the coal carbonised during the past half-year was 29,476 tons. The gas made was 294,757,000 cubic feet; quantity not accounted for 21,074,700 cubic feet, or no less than one-fourteenth of the whole made.

We read that the Swan United Electric Light Company has sold to the Russian Government, for £100,000 in cash, the exclusive right to use the company's inventions throughout the Empire, and also to sell lamps. This company is apparently doing a very good business in a quiet way. Stockbrokers also appear to be of this opinion, as the shares of the company remain steady in price, while those of other companies (except the Hammond) show a very decided decline.

Her Majesty's troopship *Malabar* is to be lighted throughout by Edison lamps. There are to be 104 of 16-candle power, and 269 of 8-candle power.

A contemporary says that up to the 20th December last 29,192 Edison lamps were in use in America, and that up to the commencement of February 19,536 lamps were in use in Europe.

The Western Union Telegraph Company (of America) is about to establish an extensive underground system. The work is to commence in New York, where it is intended to lay a tube large enough to hold two hundred wires. In England the tubes or pipes can rarely contain more than thirty wires.

The chairman of the United Telephone Company states that on the 28th ult. there were 2,541 subscribers to the London Exchange.

There is every prospect that the Engineering and Metal Trades Exhibition, which, as we have previously announced, is to be opened at the Agricultural Hall on July 5, will be a great success. It is intended mainly as a business undertaking; but the scope is so wide, and the confidence reposed in the manager, Mr. Samson Barnett, Jun., is so great, that there cannot fail to be a great deal that will be interesting to all. We believe the available space is being rapidly occupied.

It has been lately calculated that this frostless, wet winter will cost the country at large full ten millions sterling. The agricultural returns tell a deplorable tale for the farmer of reduced wheat areas and diminished flocks and herds. Looking back the other day to twenty years' record of the increasing dependence of this country on foreign sources for its food-supply, we were much struck by the subjoined facts. In 1860, when the population was 28,778,411, the imports of cattle were valued at £2,117,860; and those of corn, grain, and flour at £31,676,353. In 1879, when the population had advanced to 34,155,126, the value of the imported live stock had risen to £7,075,386 per annum, and that of corn, grain, and flour to £61,261,437. The value per head of population grew during this period from £1. 9s. 1d. to £2. 19s. 3d. —P. R.

Etna. — A correspondent of the *Times* writes from Naples, Feb. 23: "Etna is again in a state of eruption, though apparently not of a violent character. Professor Silvestri, who is the guardian of that volcano, as Professor Palmieri is of Vesuvius, writes from Catania after the following manner: 'The explosions which from the bottom of the crater succeed one another incessantly at intervals of four or five minutes, besides projecting hurricanes of steam, laden with the finest ashes and minute sand, send out also scoriæ and large fragments of incandescent lava, which constitute a decided eruption in the central crater. For this reason the summit of the mountain is seen at a very great distance all illuminated by a blazing light. The whole of the matter ejected, which is diffused on the outside, is seen to be formed of fragmentary lava, *molto elaborati*, and "profoundly" attacked by the action of acid vapours; the very fine ashes are intermixed with abundant and glittering microlitic crystals of calcareous sulphate. On Feb. 7 the seismograph of the Observatory Pennisi, in Acireale, registered a slight perpendicular movement, and on Feb. 11 the instruments at Catania revealed from 9 p.m. to 5.30 a.m. an extraordinary microseismic storm, which attained its *maximum* later at 3 p.m. The eruption of mud at Paterno has ceased, not presenting more than a weak residuum of action, as happens in its normal state.'"

A NATURALIST'S YEAR.

By GRANT ALLEN.

VIII.—SNOWDROP AND SNOWFLAKE.

THE little seaward combe where I am wandering this morning on a botanizing expedition is the only spot in England where the spring snowflake grows truly wild of its own accord in the open meadows. There are other places, no doubt, where it has spread a little as a straggler from modern borders, or as a survivor from old cottage gardens, and where it lingers on for a few years in a precarious fashion; but, in this sheltered nook of the Dorset downs where I have come to search for it to-day, it has sprung up afresh, season after season, for many years together; and as it grows in company with several other rare southern species of half-naturalised English flowers, there can be little doubt that, however it originally got here, it finds the climate quite mild enough to suit its tender constitution. It may have escaped from cultivation ages since, perhaps from the grounds of the old monastery in the glen beneath; or it may have been cut off in this its furthest outlying habitat far earlier still, when the waters of the sea first slowly wore their way through the bed of the English Channel, leaving this little colony isolated all alone from the rest of its kind elsewhere; but at any rate here it is, and as one more acquisition to the scanty British flora, we may welcome it heartily without inquiring too critically into its doubtful antecedents. You will not find it described as British in any of the text-books, however; for it is not held to have acquired letters of naturalisation as yet; the only snowflake acknowledged as a true denizen of England by the flora-writers is the summer species, which flowers later in the season, with a cluster of four or five white blossoms at the top of each slender green stem, instead of a single bell only, as in this earlier species. That summer snowflake grows more abundantly in many parts of south-eastern England, and so has been fairly adopted into all our handbooks; but it is not so convenient a flower for comparison with the snowdrop as its spring sister, both because it does not so nearly approach it in character, and because the two do not flower together at the same time. Though the wild spring snowflake is so rare, it is easy to get at garden specimens, both of it and the snowdrop; while I know few more instructive lessons in what is called biological specialisation than that which can be gained by comparing together these two closely similar white blossoms.

Both the snowdrop and the snowflake belong to the family of amaryllids; that is to say, they are lilies somewhat artificially separated from the remainder of the lily group, because their corolla-tube has so grown up around the central portions of the flower as to completely enclose the fruit, thus producing what is called an inferior ovary. If such lilies still possess the normal number of six stamens each, arranged in two whorls of three apiece, they are known as amaryllids; while, if one whorl has been suppressed, so that there are only three stamens altogether, they are rather needlessly separated under the name of irises. Now, the spring snowflake may be accepted as a very good typical specimen of the simplest amaryllids. It has three sepals or calyx-pieces, and three petals or corolla-pieces; only, as in so many other plants of the great lily alliance, these two whorls exactly resemble one another in colour and texture, and cannot be distinguished save by the fact that three of the pieces overlap the other three at the base, thus just suggesting the underlying difference between the outer and the inner row. Each such perianth-piece is a dull white in hue, tinged with faint green near the tip. The snowflake is a pretty, graceful flower; but it is a decidedly simple and undeveloped type of primitive amaryllid.

The snowdrop, on the other hand, exhibits the self-same type a good deal more advanced and specialised in the flower, evidently through the agency of higher insect selection. In all other particulars the two plants resemble one another very closely. Both have bulbs containing the store of underground nutriment which enables them to blossom so early in the season; both have long narrow leaves, those of the snowdrop much like the foliage of the crocus, those of the snowflake a little more like a small narcissus; and both have a tall scape, surmounted by a little green sheath or spathe, papery in one part and fleshy in another, enclosing a single drooping flower, and thus testifying very clearly to their common descent at no very remote period from a similar ancestor. But the actual blossom of the snowdrop shows many marks of higher development which admirably illustrate Mr. Herbert Spencer's law that evolution runs from the homogeneous to the heterogeneous, and from the indefinite to the definite; or, in simpler words, from the like to the unlike, and from the vaguer to the more distinctly marked.

First of all, look at the outer perianth pieces. In the snowflake all six are almost exactly alike in shape, size, and colour, being whitey-green in hue, and pointed in form. But in the snowdrop, the three outer pieces have been differentiated (to use Mr. Spencer's word) from the three inner ones in all these particulars. They have grown longer, rounder, and more purely and delicately white. All the green tinge that they had in the snowflake has here disappeared, and the sepals of the snowdrop are as pure and spotless in hue as the snow itself from which they take their name. Observe, too, the way in which they bend out and in again, so as to mark themselves off very definitely from the pieces within. And yet note that, without some initial difference of position, this greater final difference of appearance and function could never have been brought about. The snowflake has three outer pieces just distinguishable from its three inner; and on that prime contrast of position selective action has gradually wrought all the rest.

Next, look at the three inner segments in the snowdrop. Here one sees at once that the originally similar and pointed pieces have grown smaller and rounder, and have been notched at the ends instead of being sharpened, so that they now form a quite distinct and unlike inner whorl. Once more the indefinite greenness at the end of the petals and sepals in the snowflake has here disappeared entirely from the sepals, but it has been intensified and rendered far more definite in the petals. On their outer surface, the green pigment assumes a crescent shape, beautifully diversifying the two whorls, and clearly marking for the bees the position of the honey-bearing part of the flower. On the inner surface of the petals, again, the difference is even more marked; for here we get a series of distinct and parallel little green lines, with white interspaces; and these green lines act as direct honey-guides, leading the bees straight to the nectar gland at the base of the petals. There can be no doubt that the cause operating to produce this change towards greater unlikeness and definiteness of parts is the selective action of insects. They have constantly chosen for unconscious fertilisation in their honey-seeking excursions those flowers in which they could most easily discover the whereabouts of the nectar, and have thus produced all those features of the snowdrop in which it differs conspicuously from its snowflake-like ancestor.

At the same time, we must not imagine that the existing

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spring snowflake is the exact primitive form from which the modern snowdrop is derived. Such survival of parent and derivative types side by side, the parent remaining unchanged while the other has widely varied, seldom or never occurs in actual nature. There is one particular in which the snowflake on its part has become more highly developed than the otherwise more advanced snowdrop, and that is in the nature of the stamens. The snowdrop stamens are pointed at the end, and arranged in a little cone in the centre of the flower; and they open by a long slit down the inner side, after the common fashion of most amaryllids. The snowflake stamens, on the other hand, are peculiarly blunt at the top, where they open by two odd little terminal pores, which give them a very quaint and truncated appearance. This shows that the snowflake is not itself the original ancestral type, but has varied on its side, too, from the primitive ancestor; and there can be no doubt that the change depends upon some special method of insect fertilisation, though a simpler one than that of the very complex snowdrop. Oddly enough, by a blunder copied over and over again in many books, it is usually said that the snowdrop stamen opens by pores while the snowflake stamen opens by a slit on the inner surface; but a single glance at the flowers themselves will show at once that the opposite is really the case.

"OUR BODIES:"

SHORT PAPERS ON PHYSIOLOGY.

By Dr. Andrew Wilson, F.R.S.E., &c.

No. VII.—THE PROCESSES OR FUNCTIONS OF THE BODY.

THERE is an animalcule, averaging in diameter the one-five-hundredth of an inch, or thereabouts, found in stagnant pools, and called the *Amœba*. The name of the animalcule is derived from the Greek for "change." In appearance it is a mere speck of living jelly, which is ever changing its form—ever flowing, so to speak, from one shape to another. The living matter whereof the amœba consists is called *protoplasm*. This substance closely resembles white of egg (or *albumen*) in its chemical composition. It is the one substance which seems to be inseparable from life; or to put it more exactly, life is nowhere known or heard of except as exhibited by some form or other of "protoplasm." Whatever may be the relations of protoplasm to life—a topic I need not discuss here—this much is assured, that life, as we know it, seems to require protoplasm or albuminous matter for its exhibition and mere existence. Protoplasm, in this way, becomes truly the "clay of the potter," woven by the powers that be into the wondrously varied warp and woof of living beings.

The Amœba, then, is a protoplasm-speck. It takes in food particles by any part of its frame, and it appears capable of digesting them in any part of its body. There is no mouth, stomach, heart, breathing organs, or nervous system. Yet the animalcule *lives*, and lives as perfectly in its own simple way as the man. There seems, indeed, a wide gulf betwixt humanity and the Amœba, but it is a gulf that is by no means impassable, when we consider that a community of likeness (in the essential nature of their living parts) and a sameness of function (in respect of the actions of life) characterise this lower form of life and the sphere of human hopes and fears. We shall have to refer hereafter to the Amœba as a type of a considerable number of actions which the physiologist studies in man, and it will serve a good purpose if we, therefore, bear the humble denizen of the pool, with its soft protoplasm body, clearly in mind.

Every living being—animal or plant, monad or man—performs three great functions in the course of its existence. The physiology of any animal or plant can be summed up in the expression, that the whole business of life, so to speak, consists of three great processes, which include many minor processes within their limits. There is, firstly, the function of *Nutrition*, whereby the animal or plant nourishes itself, digests food, and repairs its ever-recurring waste. Then, secondly, succeeds the process of *Innervation* or *Relation*. Through the exercise of this latter function, the living being brings itself into "relation" with the outer world by means of its nervous system. To the discussion of the functions of the nervous system, this second department of physiology is, therefore, devoted. But hosts of animals and plants die daily. Continually the units of a race perish and drop into the grave. Hence a third function—that of *Reproduction*—renews the *race*, just as "nutrition" renews the *individual*. New animals and plants are thus brought into the world to take the place of their fellows that have succumbed in the battle of life.

It is clear that whilst these three functions represent the collective type of the animal or plant, there must be many subdivisions of each action or duty. For example, the function of *nutrition* includes every action through which the *individual* body maintains its place in the world. Under this single head what subjects fall to be considered? The reply is—firstly, *foods;* then *digestion*—itself a comprehensive topic; then the *blood*, into which food is converted; next *circulation*, which distributes the blood to all the tissues of the body; and then comes *excretion*, or the getting rid of waste matters. This latter duty is performed by lungs, skin, and kidneys, so that the single word *excretion* stands for and implies the functions of breathing, of the skin, and of the kidneys respectively. Of the other two main functions of the body, the same remarks hold good. Each function is susceptible of division into a large number of lesser actions and details. The so-called "life," then, of a human being may, without any straining, either of physiological language, ideas, or facts, be described rather as a series of "lives," than as one life. And this latter contention becomes plainer when we reflect that in our blood, as well as in other fluids of our frames, there are "cells" or minute living particles, which certainly possess a power of motion independent of the body of which they form part, and which also exhibit a vitality that is not dependent upon the frame, through whose blood-vessels they perpetually travel.

For our present purpose, however, it must suffice that we regard the varied processes and actions of the body as existing in a close unity which lies on the surface of things. Health and a truly enjoyable life are only possible to us when this unity is maintained. Derangement of one function is apt to cause aberration of many functions; and we can only live a perfect and healthy life, physically, when every organ, part, and tissue co-operates with its neighbours in the maintenance of the whole bodily existence.

Our first consideration must be devoted to the consideration of the function of *nutrition*. It is only natural that we should first seek to know how our bodies are nourished. *Why* they are nourished we have already seen. Waste and wear are inseparable from existence. Every act of life means the wear and tear of the organ which works. Hence, it is to repair and renew the perennial waste which the living body undergoes, that *nutrition* devotes all its energies.

The means whereby we repair waste are largely summed up in the words *food* and *digestion*. *Food* is the material

from which we derive the new matter for living upon, and *digestion* is one word for many processes whereby this food is converted into a fluid capable of being added to and poured into the *blood*. Digestion, then, is merely the link which connects the food and the blood. Through digestion we convert food or matter that is more or less unlike ourselves into ourselves.

The apparatus by which this action is effected is called the *digestive system*. Each collection of organs in a living body (the organs being devoted to the performance of a function) is called a "system." Heart and blood-vessels form a "system"—that of the *circulation*. Lungs, skin, and kidneys—forming a kind of natural trio—constitute the system of *excretory organs*, which are devoted to getting rid of waste matters. And in the *digestive system*, we find a whole series of organs which perform, each, an important part in the work of food-elaboration. Thus, there are the *mouth* and *teeth*; then come the *salivary glands* of the mouth. The stomach and intestine come next, the food passing through these parts. The *liver*, "sweetbread" (or *pancreas*), *gastric glands* of the stomach, and the glands of the intestine are all so many organs which discharge duties connected with the conversion of food into a fluid capable of being added to the blood.

But last of all, it is possible to form a generalised idea of this complex system of digestive organs. We ought to think of any digestive system as merely *a longer or shorter tube* through which food passes, and in which food is subjected to the action of fluids thrown in upon it by certain glands (liver, sweetbread, &c.). Such a simple idea—that of a tube with "glands" attached to its sides—perfectly describes the digestive system of any animal.

DISCOVERIES AT TEL-EL-MASKHUTA.

By Amelia B. Edwards,

Hon. Secretary Egyptian Exploration Fund.

WHEN, in my concluding words on the subject of Pa-Rameses and Tel-el-Maskhuta,* I expressed a hope that "pick and spade might ere long be called in to set to this problem," I little thought that the means would so soon be forthcoming, and the effort so promptly be made. Five weeks ago, the Egypt Excavation Fund, having no president and no money, existed only as a committee. Now, thanks to Sir Erasmus Wilson, who has accepted the vacant chair and fed the empty exchequer, our society has been enabled to make its first start in life; and, as all know who read the daily papers, operations have already been begun upon Egyptian soil. For the rapidity and success with which these operations have been conducted, the society is indebted to M. Naville, one of the most eminent of living Egyptologists, who has accepted the direction of the excavations. M. Naville, having left for Egypt upon a very brief notice, arrived in Cairo on January 19, just in time to see Professor Maspero, who was on the point of starting for Upper Egypt, and who, in point of fact, left the port of Boolak that same evening. The result of their conference was that Professor Maspero recommended, and M. Naville decided upon, the examination of Tel-el-Maskhuta. Whether M. Naville was, or was not, influenced to this decision by any kindly interest which he may have taken in my contributions to Knowledge (though they could teach him nothing new), I do not pretend to say; but, to the best of my belief, Professor Maspero, who especially advocated the choice of this site, has never seen a line of those contributions, and was solely influenced by the desire to settle a long-disputed question. For my own part, I can only say that the decision took me by surprise, and that I had supposed the work would be begun elsewhere.

Having secured the services of an experienced engineer and a gang of eighty labourers, M. Naville attacked the mound during the first week of the present month, and, on the 12th inst., wrote to my co-secretary, Mr. R. Stuart Poole, to announce the important discovery by which his first week's work had been rewarded. This report came to hand on the 20th inst., and its contents were communicated to the leading papers by Mr. R. S. Poole, in the following letter:—

"M. Naville writes from Tell-el-Masckuta to announce that the excavations undertaken by him on that site for the Egypt Exploration Fund have already yielded a result of the first historical and geographical importance. This site (Tell-el-Masckuta), roughly midway between Ismailia and Tell-el-Kebir, is proved by an inscription dug up by M. Naville to be at once the Pithom and the Succoth of the Bible. Pithom was the sacred name descriptive of the Temple, and Succoth (Tuku) the civil appellation. We read of Pithom as one of the cities built by the Israelites during the oppression (Ex. i., 2), and Succoth was the first station in the march of the Exodus (Ex., xii., 37; xiii, 20). The discovery not only places Pithom-Succoth on the map, but in doing so gives us at last a fixed point in the route of the Israelites out of Egypt. A full discussion of the results of this discovery would be premature, but it may be remarked that it greatly modifies Dr. Brugsch's attempt to reconstruct the primitive geography of the Delta, which, like a broken geographical puzzle, will now be put together. It must not, however, be forgotten that with the help of his collection of literary documents the labour is comparatively easy. It is to be hoped that the work to which M. Naville has devoted his great knowledge will not languish for want of funds. Hitherto it has been supported single-handed by Sir Erasmus Wilson.—Your obedient servant,

"Reginald Stuart Poole,

"Hon. Secretary Egypt Exploration Fund.

"British Museum, *Feb.* 20."

To this I will only add that, since "Pithom" is found, I am well content to have been mistaken as regards the site of "Raamses." My inquiry was but a search after historical truth; and if that inquiry has, however remotely, opened the way to the work which is now being done, I hold myself not to have suffered defeat, but to have achieved success. Far rather, indeed, would I be proved wrong than right in this matter of "Pithom" *versus* "Raamses"; for important as would have been the identification of "Raamses," the identification of "Pithom-Succoth" is from every point of view infinitely more momentous.

* See Knowledge, No. 64, January 19th, 1883.

Hydrogen is completely absorbed by palladium sponge at 100°, and Mr. W. Hempel has used this as a means of separating hydrogen from a mixture of gases. In order to test the applicability of this property to the estimation of hydrogen evolved in sealed tubes, Herr Tschirikow treated zinc with hydrochloric acid in a sealed glass tube containing a palladium spiral. The proportions of acid and zinc were such as to produce a pressure of twenty-five atmospheres if no hydrogen were absorbed by the palladium. The absorption was found to be complete. A small portion of the hydrogen had united with the oxygen of the air remaining in the tube. Nearly the calculated amount of hydrogen was obtained from the palladium spiral by heating to 350°. The evolution of the gas was so regular that Tschirikow suggests the heating of palladium-hydrogen as a means of obtaining chemically pure hydrogen.—*The Engineer.*

LEARNING LANGUAGES.

By Richard A. Proctor.

(*Continued from p.* 100.)

THE method applied in my last paper to Latin is, in the following passage, taken from one of the excellent works on the Hamiltonian method (now published at a very moderate rate—see our advertisement columns) applied to German.

I do not give the Hamiltonian translation this time, leaving the student to look for it in the little book itself, "Robinson der Jüngere." What follows is the German passage, unaltered in arrangement, with my own absolutely literal translation, placed word for word under the German. After that, a free translation is given—in which the sense is carefully rendered, so that of necessity the English is not quite as an Englishman would write it.

Der Tiegel zersprang nicht, aber er wollte doch
The pipkin outsprang not, but it would though
auch nicht überglaset werden.—Und warum denn
also not overglazed become.—And wherefore then
nicht? dachte Robinson wieder. Das Feuer, meine
not? thought Robinson further. The Fire, think
ich, wäre doch wol stark genug gewesen; was
I, would though well strong enough have been; what
mag denn nun doch fehlen? Nachdem er lange
may then now yet fail? After-that he long
darüber nachgedacht hatte, glaubte er endlich den
thereover towards-thought had, believed he lastly the
rechten Fleck zu treffen. Er hatte, nämlich, den
right Flaw to hit. He had, namely, the
Versuch in einem Feuer gemacht, welches in keinem
Trial in a Fire made, which in no
Ofen eingeschlossen war, sondern in freier Luft brannte.
Oven inclosed was, but in free Air burned.
Aus diesem ver-flog die Hitze viel zu schnell,
Out-of this off-flew the Heat much too quickly,
und -breitete sich zu sehr nach allen Seiten
and -spread self too much to all Sides
aus- als dass der Thon dadurch hätte
out- as that the Clay that-through [*could*] *have*
können bis zum Verglasen glühend werden. Seinem
been-able up to-the Glazing glowing to-become. To his
Grundsatze, "nichts unvollendet zu lassen," getreu,
principle, "naught uncompleted to leave," true,
beschloss er also, einen ordentlichen Schmelzofen
resolved he so, one [*a*] *regular Melting Oven*
anzulegen. Aber zu dieser Arbeit musste er eine
to-lay-out. But to this labour must he one
bequemere Witterung abwarten. Es regnete, nämlich,
more-convenient Weather await. It rained, namely,
noch immer fort, und erst nach zwei Monaten -fing der
yet ever forth, and first after two Months -took the
Himmel endlich wieder an- sich auszuklären. Nun,
Heaven lastly again on- self to-clear-up. Now,
dachte Robinson, werde der Winter angehen; und siehe!
thought Robinson, will the Winter on-go; and see!
der Winter war schon vorüber. Kaum trauete er
the Winter was already over! Scarcely trusted he
seinen eigenen Augen, da er sah dass die allbelebende
his own Eyes, when he saw that the all-enlivening
Frühlingskraft schon wieder neues Gras, neue Blumen,
Spring's-power already again new Grass, new Flowers,
und neue Kräuter hervortrieb; und doch war es wirklich
and new Herbs, forth-drove; and yet was it really
so. Die Sache war ihm unbegreiflich, und gleichwol
so. The Thing was to-him ungraspable, and equally-well
sah er sie vor Augen. "Das soll mir, dachte
saw he it before [*the*] *Eyes. "That shall to-me, thought*
er bei sich-selbst, eine Lehre sein, dass ich künftig nicht
he by himself a lesson be, that I in-future not
gleich Etwas läugne, was ich nicht begriefen kann!"
straight something deny, which I not begrip can!"

Free Translation.

The pipkin did not burst, but it did not become glazed. And why not? thought Robinson next. The fire, I think, must have been hot enough—what can be still wanting? After he had long reflected about this, he believed he had found what was amiss. It was that he had made the trial in a fire which was not enclosed in any oven, but burned in the open air. The heat escaped from this much too quickly, and was dispersed all round too freely to be able to heat the clay to the glazing point. True to his principle that nothing should be left untried, he resolved to build a regular oven. But for this work he was obliged to await better weather, for it rained continually, and only after two months did the sky begin to clear. Now, thought Robinson, we shall have winter; but, lo! winter was already over! He could scarcely trust his own eyes, when he saw that the all-vivifying power of spring already brought forth new grass, new flowers, and new herbs; yet so it was. He found the thing inconceivable; yet there it was before his eyes. "This shall be a lesson to me," he thought to himself, "not forthwith to deny what I cannot understand."

THE ROYAL AQUARIUM ELECTRIC EXHIBITION.

THAT the management of the Westminster Aquarium should undertake the formation of an electric exhibition so soon after the in-one-sense successful essay on the part of the Crystal Palace Company, was, on its first announcement, regarded as a very risky experiment. The repetition of a success rarely satisfies anybody, and perhaps least of all those most directly concerned. The truth of this has been fully exemplified at Sydenham. Nevertheless, considering the eminently central position occupied by the Aquarium, and the fact that the building is not compelled to close at so early an hour as the Crystal Palace, it gradually began to be hoped, almost expected, that the venture at Westminster would contradict the verdict on its competitor. So much was this the case that nearly two hundred intending exhibitors sent in their names. The date for opening was originally fixed for the first of last November, but it soon became clear that a postponement would be necessary. The opening was accordingly put off from time to time, and it was only on Saturday last that the Exhibition was declared to be ready for public inspection. With very great regret, however, we have to record that the old lesson is again forced upon us, and that great as was the prospect of a first-rate display, the realisation falls short of the least sanguine anticipations. What is at present to be seen is, generally speaking, good; it only lacks diversity and quantity. There is little doubt but that many more exhibitors will put in an appearance now that the opening has become a *fait accompli*, although it is probable that several intended exhibits have already gone the way of all things, few having survived the trying period which has

elapsed since the Stock Exchange excitement of last summer.

The electric light is naturally the chief attraction of the exhibition, but this section can scarcely be regarded as fully representative. Messrs. Siemens have twenty-six of their arc lamps, the dynamo being driven by a Robey engine. The work is performed but indifferently, and as the installation constitutes part of the ordinary lighting arrangements of the building, it can scarcely be looked upon as forming part of the Exhibition. The only other arc lamps of which there is any immediate prospect of being lighted are the well-known Pilsen and the Mathiesen, the dynamos for which are to be driven by Hodson's Rotary engines. These engines may be very well in their way, but they are not, in our opinion, calculated to bring much credit to the exhibits. Their speed is far too high, and they are too liable to vary to command our approbation. The Joel lamp is the only semi-incandescent light at present visible, although, in the absence of a catalogue, it is impossible to predict all that will yet be forthcoming. It is to incandescent lamps that the energies of the majority of the exhibitors appears to be directed, although we can see or hear nothing of the Maxim lamp, which shone to such advantage in the north nave of the Crystal Palace last winter. Nor is there any prospect of a display of the Lane-Fox, British, or Fitzgerald lamps. The field is apparently in the entire command of the Edison and Swan lamps, and their exhibitors evidently intend doing their best to secure an undivided verdict. How far they will succeed, if such be their object, it is difficult to say, and it is equally difficult to conceive anything more pretty or more chaste than many of the conceptions already, or soon to be carried out.

In a shed, at what may be called the north-east corner of the building, is a 25-horse-power engine, by Davey Paxman, & Co. This is to drive two Edison's dynamos and a Ferranti dynamo. The former are to supply the current necessary for 240 Edison lamps; and the latter, we are told, for 500 Swan lamps. Owing to a difficulty in the matter of belting, one Edison and the Ferranti are at present running alternately. The Edison requires a speed of 1,200 or 1,300 revolutions per minute, while the Ferranti requires 2,000 revolutions to supply the necessary current. That this latter speed is highly prejudicial to the mechanical portion of the machine is rendered apparent by the fact that the present machine is the third tried, the two others having been so much injured as to necessitate their removal. Of course, we must not lose sight of the fact that the machine is a very small one (as will be seen so soon as we can find space to describe it), and, therefore, a high speed does not mean nearly so much as it would in a machine of any other type used to supply the same number of lamps. The Swan lamps supplied by the Ferranti are used for illuminating the Bath-room, &c., but little is at present to be said of the performance. The Edison lamps, of which there are at present about a hundred in use, are illuminating a suite of apartments in the Western Gallery. Doubtless, the most attractive portion of this display is the "Grotto," which is exceedingly pretty, and shows to what a state of perfection the incandescent lamp can attain in response to the artistic requirements of the age. Close to this exhibit is a display by Messrs. Edmundson & Co., agents for the Swan Company. They have already 163 lamps arranged in a multiplicity of most cunning devices. Part of the exhibit takes the form of an elegantly-appointed drawing-room, to the decoration of which the Swan lamp lends itself very considerably. Pendant from the centre of the ceiling is a bright brass chandelier supporting fifteen lamps, each of which is encased in a rose-tinted glass hood. The effect of the light shining through these on to the brasswork is very striking. Outside the room is another brass chandelier, very beautiful in design, which is intended to carry forty lamps. When everything is complete, this exhibit will be interesting to the last degree. There are to be in all 250 lamps. A Siemens' dynamo is in use, and is driven by a 25-h.p. engine of Messrs. Davey Paxman, & Co.'s, fitted up in a temporary shed attached to the north-west corner of the building. The difficulties surmounted by the representative of these first-class engineers may be almost described as Herculean, and great credit is due to him for having so satisfactorily and so fully achieved his task. In the same shed he has fitted another engine—one of the firm's thirty-horse-power single cylinder engines, having two separate boilers to supply the requisite steam. The two engines drive on the same shaft, which, when the electricians are ready, will supply the motive-power for working the dynamos required for Messrs. Edmundson & Co.'s Swan Lamp exhibit and a number of Jablochkoff lamps. Messrs. Patterson & Cooper will also exhibit the recently-introduced Elphinstone and Vincent Dynamo, and another patented by Messrs. Levey & Lumley.

There are good displays of pneumatic and electric bells, the best being that of the Signal Engineering Company. The only other feature we can now refer to is the "Secondary Generator," patented by Messrs. Gaulard & Gibbs. In this apparatus it is intended to convert a current of a given pressure, or electro-motive force, into other currents of any desired electro-motive force. This is accomplished on the principle of the Ruhmkorff coil. The original currents traverse a primary coil, and, in so doing, induce currents in a number of enveloping coils. If these latter coils are joined in "series," a high-tension current is derived, while joining them in parallel circuit causes a low-tension current to be developed. It is claimed that this apparatus will revolutionise and render practical in every sense of the word the application of electricity to domestic and commercial purposes. Time will prove how far the anticipations of the inventors will be realised, but we will refer more fully to the exhibit in our next notice.

It is to be earnestly hoped that intending exhibitors will now hamper the directors as little as possible, and do their best to make the exhibition a success.

THE GREAT COMET OF 1882.—II.*

By Professor C. A. Young.

WHEN the writer first saw the comet, on September 19, it was impossible, with the great twenty-three-inch equatorial, to make out much except the nucleus itself. The comet was so near the sun that the object-glass could not be screened from the direct sunshine, which filled the whole field with glaring light. The finder of the instrument is itself, however, a powerful telescope of five inches aperture, and this was perfectly screened by the great tube, so that it furnished an admirable view of the beautiful object. To the naked eye the comet looked like some white-winged bird in swift flight towards the sun. The telescope showed the wings to be long, curved streams flowing backward from each side of the head—backward, that is, with reference to the sun; but they were, of course, really in advance of the comet, which at this time was receding from the sun. The head of the comet had for its centre a small round and brilliant nucleus, not well

* From the *Popular Science Monthly*.

defined, but rather a nebulous star, some 4″ in diameter; in front of this at a distance of perhaps 30″ was an "envelope," and there was a second one at a distance of 2′ or 3′. They were connected by a pair of eccentric circular arcs, and these arcs, coalescing with the outer envelope and prolonged, formed the skeleton of the "wings." Back of the nucleus, traces of the usual dark stripe could be detected. Fig. 2 presents the main features in outline, and every one

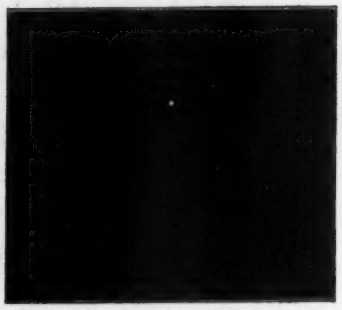


Fig. 2.—Head of Comet September 10—9-inch telescope.

will notice its close resemblance to Brodie's picture of Coggia's comet as seen on July 13, 1874. (The picture alluded to forms the frontispiece of Chambers's "Descriptive Astronomy," third edition.)

On the next day the comet was seen at Princeton for a few moments through clouds, just long enough to get imperfect observations for position, but nothing more. It was noticed, however, that the eccentric arcs had disappeared. On October 2 the comet was observed for more than an hour before daybreak with the great telescope. The most notable features were a single bright cap or envelope at a distance of about half a minute from the nucleus, and the nucleus itself, which, instead of being round, was considerably elongated. There were, however, no jets, or starfish-like projections, such as the comet of 1881 presented so often. There was not much of structural detail to be made out in the head of the comet, but the dark stripe behind the nucleus was very conspicuous. This dark stripe, by-the-way, is a very remarkable phenomenon, not yet explained, so far as we know, though observed in most large comets. The common impression is, that it is merely a space behind the nucleus, screened as it were by the nucleus itself, from the rush of luminous matter which is being driven backward by the sun's repulsion. But if this be so, then, as Mr. Proctor has pointed out in a recent article, there is no reason why it should appear so well defined and so dark. The cross-section of the tail, a little way behind the nucleus, was, in the present case at least, 100,000 miles in diameter: now, merely taking away the luminous matter from a tunnel 6,000 or 8,000 miles in diameter along the axis of the tail, could make but little difference with the amount of light received by the eye at a distance. If there were no tunnel, we should get from the central line of the tail the brightness corresponding to a thickness of 100,000 miles of luminous matter. Boring the tunnel would only reduce it to some 90,000 miles, and the difference would be hardly perceptible.

It seems more likely, if the writer may venture the suggestion, that the stripe is a stream or beam of non-luminous, cooler-vapour or gas, which is nearly opaque to the radiation emitted by the same kind of gas when luminous, and therefore cuts off all the light from whatever portions of the comet's luminous drapery is behind it; in the same way that cool sodium-vapour, for instance, is relatively opaque to the light of a sodium-flame. If this is correct, the dark stripe ought not to be black, but just about half as bright as the neighbouring nebulosity; which corresponds to the actual fact. If one could catch a star passing behind the stripe, it would perhaps be easy to settle the question. At any rate, if the star shone more brightly when in the stripe, we might be sure that the hypothesis is wrong. The star should be dimmed a little, if anything, though, of course, *star*-light would not be so much affected as the light from cometary matter. Mr. Proctor has suggested a different hypothesis,* which seems to the writer rather less probable, but there is no time to discuss it here.

On October 4th the nucleus had become much more elongated, so as to be shaped something like an Indian club. The envelope, which was conspicuous on the 2nd, had disappeared, or degenerated into an indefinite nebulosity, and the dark stripe had become much fainter.

Continued bad weather prevented observation until the 10th, and on this date the nine-and-a-half-inch telescope of the School of Science Observatory was used. A great change had taken place. The nucleus had become an irregular, spindle-shaped streak some 40″ long, made up of six or eight star-like knots of luminosity connected and veiled by shining haze. One of these knots, about a third of the way from the sunward extremity, was considerably larger and brighter than any of the others, and should, perhaps, be considered as the true nucleus. The next one beyond it (reckoning from the direction of the sun) was second in size, and separated by an interval of 2″ or 3′, the space being filled, however, with nebulosity. The dark stripe was still visible, but directed, not along the prolongation of the nuclear streak, but inclined at an angle of 8° or 10°, while a *bright* jet from the nucleus, two or three minutes in length, touched one side of the dark stripe, and kept nearly in the axis of the tail.

Fig. 3.—Head of Comet, Oct. 10, 1882.

Fig. 3 is an attempt to illustrate the appearance and

* I believe Prof. Young's theory to be nearer the truth than the one I suggested. But some observations of my own lead me to doubt whether the mere shadow of the nucleus would not suffice to explain the dark streak (despite my own objections, mentioned above by Prof. Young, to this theory). I over-estimated the darkness of the streak, and under-estimated the effect of contrast on ordinary eyesight. As to this last point, I made a little observation a few evenings since which may be worth recording. Walking with Mrs. Proctor on the Brighton Parade late in the evening, when there was a good deal of mist in the air, my attention was called by her (almost at the instant that I had noted the phenomenon myself) to what looked like a long, nearly black streak extending vertically upwards above the nearest street-lamp. Of course, this dark streak was the shadow of the knob on the top of the lamp-case; but there was plenty of illuminated air both beyond the shadowed region and between that region and ourselves. The loss of light from the long conical region of air in the shadow of the lamp-knob was, in fact, much more obvious than we should have expected it to be. The darkness could only be recognised, we found, when one of the side bars of the lamp-frame hid the flame of the lamp from view.

relation of things by a mere outline sketch, which, of course, cannot be considered in any sense a *representation*, since it fails entirely to give an idea of the shading and gradation of light. The head of the comet presented no definite outline whatever, and the nucleus very little. The knots were mere condensations of brightness in the midst of diffuse light. When the dawn came on, the fainter parts successively disappeared, so that at a certain stage the nucleus seemed to be divided into two portions. A small telescope would probably show things in the same way even before dawn, and this is undoubtedly the origin of the reports that the comet had split in two.

This great and unprecedented elongation of the nucleus is a most remarkable phenomenon. If it had occurred at or near the time of perihelion passage, it might have been naturally attributed to the divellent action of the sun's attraction; but it is a little difficult to see why the thing should have pulled out and come to pieces in such a way after getting safely by the crisis. It is worth noting that this peculiarity of the comet adds greatly to the difficulty of making accurate observations of its position: one does not know just upon what point to direct his instrument.

Continuous cloudy weather prevented any observation of the comet until the 15th. On that date the appearance of things as seen in the great equatorial was very much what it had been on the 10th with the smaller telescope. There were no envelopes, and the only "jet" was the bright streak following the nucleus. The dark stripe had wholly disappeared, as if obliterated and replaced by the bright one. The "knots" in the nucleus were seen to be irregular in form, and were arranged not in a straight line but in a somewhat broken curve, conforming to the curvature of the tail, which at this time extended 18°, and was fully 60,000,000 miles in length. The bright stream originated not at the extremity of the nucleus, but came out tangentially from the convex side, and perhaps had its source in the largest of the knots, which was now the third from the sunward extremity. The whole length of the nucleus measured 48½″, corresponding to a length of more than 40,000 miles, the diameter of the largest single mass being about 5,000 or 6,000 miles. The only other observation we have been able to make at Princeton was nine days later, on October 24th. No material changes were noticed, though the comet was very much fainter. The same lengthened granular nucleus continued, and seems likely to persist until the comet disappears.

(To be continued.)

HOW TO USE OUR EYES.—II.

By JOHN BROWNING, F.R.A.S.

(Continued from page 112.)

THERE is good reason for believing that the eye takes a photograph of every object looked at intently.

Rabbits have been held before a window for a few seconds and then killed. A picture of the window has been found on their retina.

The impression on the retina is generally said to last about the sixteenth part of a second, but this depends upon the brilliancy of the object and the length of time we look at it.

Now for some important hints for preserving your eyesight. Never look at an intensely bright light for any length of time, or a permanent image may be formed on the retina. Avoid, most carefully, exposing the eyes to a very bright light after they have been in darkness, as such changes are injurious, and have been known to produce blindness.

When using a microscope, always incline it as much as possible towards the horizontal direction. Most persons use the microscope almost upright. Looking down into the microscope in this position gorges the eye with blood by stopping the circulation in the neck.

A Newtonian reflecting telescope is very superior to an achromatic telescope for those who have any fear of straining their eyes, as the stars and other heavenly bodies can be seen best with this kind of telescope when they are directly overhead.

If a person wishes to look at them when they are thus situated, he must lie down on his back if he uses an achromatic telescope. With a reflecting telescope the celestial objects may be viewed when they are overhead by the observer looking horizontally into the telescope.

When adjusting a very bright lamp flame, if you wish to do it slowly, look at the flame through a slit formed by almost closing two of the fingers. This will protect the eyes greatly. Always turn your back to the source of light when you are reading, so that the light may fall on to the book, instead of coming into your eyes.

Fig. 3.

Fig. 4.

Always lean well back when reading, and hold the book up, as shown in the engraving (Fig. 3). Do not lean forward and face the light, as in this view (Fig. 4).

Never read by firelight in the position shown in Fig. 5. Myopia, or short sight, is often produced, particularly in young people, by reading in an imperfect light.

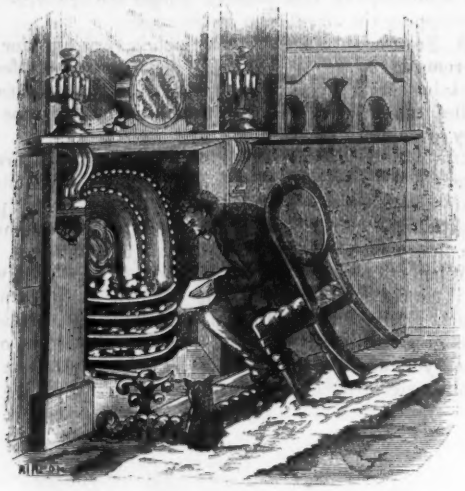


Fig. 5.

On Light.

Now I must say a few words about light.

Light is the cause of all colour. Colour is only a sensation in the brain, caused by a particular kind of light being reflected from an object into the eyes. We say trees are green, but they would not be green unless they were lighted by a light which contained green rays. This can be proved by a simple, yet perfectly convincing, experiment.

Place several pieces of paper of various bright colours on a large piece of white paper, taking care to avoid the use of yellow. Now illuminate these with a spirit-lamp which has had salt sprinkled on the wick; the whole of the coloured papers will appear grey.

Colour-Blindness.

About one person in every twenty-five is to some extent colour-blind, that is, cannot distinguish accurately between colours. In extreme cases such persons cannot distinguish between red and green. This defect often exists without being suspected. The worst case I have ever known was that of a workman who had been for years in my employ. One day, I gave him a number of photographed stereoscopic slides to sort into two lots—one coloured, and the other plain. Soon after he had sorted them I examined them. They were divided into two lots, composed almost equally of coloured and plain slides mixed together. This induced me to test his eyes for colour-blindness, and I found, to my surprise, that he could not tell the difference between a piece of black cloth and a piece of scarlet.

This defect may be of the greatest importance.

Both on railways and on board of ships, lamps with coloured glasses are used for signalling at night and flags in the daytime. Any sailor, guard, or engine-driver suffering from colour-blindness might be the cause of a fatal accident by mistaking the colour of the signal shown.

All such persons should have their sight tested.

I have contrived a spectroscope in which there is a complete riband or rainbow of colour. Now, I can shut out all but a small portion of this coloured rainbow, and allow only a small strip of any particular colour to appear. The person whose sight is being tested is then asked to name the colour that is visible.

An easy way of testing the sense of colour is to give a person two or three skeins of Berlin wool of different colours. Then give them a bundle of wool of mixed colours, and ask them to match the colours of them.

This test is not to be compared to that with the spectroscope for accuracy.

But under certain circumstances, even persons whose colour-sense is most acute and accurate may be deceived as to colour.

(To be continued.)

BUTTERFLIES IN WINTER.

Referring to the recent notice in Knowledge of a butterfly in winter, it may interest many readers to learn that such an occurrence is by no means rare, and results, in most cases, not from unusually warm weather forcing the insects to leave the chrysalis, but from the fact that several of our butterflies hibernate in the winged state, and may frequently be found torpidly hanging from roofs, in hollow trees, and other sheltered spots, the warm sunshine occasionally tempting them from their hiding-places.

Of our native species, ten, including the Peacock (*Vanessa Io*), the Small and Great Tortoiseshells (*V. Urticæ* and *Polychloros*), the Red Admiral (*V. Atalanta*), and the Brimstone (*G. Rhamni*), thus pass the winter. Of the others, some hibernate in the egg state, some as caterpillars, and the rest in the chrysalis. Those passing the longest period in the latter stage are the noble Swallow-tail (*P. Machaon*), and the lovely little Orange-tip (*A. Cardamines*), which become chrysalids in July or August, and remain so until the following May, no amount of frost or snow having any injurious effect upon them, but rather tending to protect them from the attacks of slugs and other enemies that in a damp mild winter do terrible damage; and experience proves that severe weather is sure to be followed by a more than usual abundance of insects.

Our general want of knowledge on the subject is evident in the last words of the familiar nursery doggerel:—

> I'd be a butterfly, born in a bower,
> Christened in a teapot, and died in an hour.

For a study of the life-history of these insects shows that our shortest-lived species has a much longer natural existence, in the winged state, than the foregoing verse implies. I recollect, one Christmas day, seeing five peacock butterflies chasing each other, and floating gracefully in the sunshine; they were at least three months old, having emerged from the chrysalis in August or September, and would—no accident befalling them—live on until May or June, when the females, with a never-erring instinct, would lay their eggs on the leaves of the common stinging-nettles, the natural food-plant of the future caterpillars, and having thus fulfilled the last duty of their harmless lives, would quickly go the way of all living things, leaving the next generation to gladden our eyes with a reproduction of the marvellous beauty of their parents.

Martin J. Harding.

Electric Lighting in Russia.—The Edison system is in use in the saw-mill of M. Johnson at Yväskylä, in Russia. Forty lamps and a dynamo constitute the plant at present. This is, thinks the *Electrician*, the most northerly point to which electric lighting has penetrated as yet; it is between the 62nd and 63rd degrees of latitude.

Our Paradox Corner.

FLAT EARTH *v.* GLOBE.

AVAILING myself of the permission vouchsafed me at the end of twelve years' patient appeal for a hearing, I now most readily and thankfully present myself as the champion of a cause which, for the first 5,500 years, was never doubted or disputed by the grandest intellects that the world has ever given birth to. It is not, perhaps, so much out of justice to me as to themselves that has influenced my opponents to accord me the privilege of stating my case and allowing both sides to be heard. Sir William Thompson said, "I maintain that science is bound by the everlasting law of honour to face fearlessly every problem which can be fairly presented to it." And Mr. Charles Reade, in a letter to the *Daily Telegraph* some months ago, declared: "Facts should always be faced. The champion of truth neither shirks nor succumbs. Either he lets hostile facts convert him, or he meets them with more facts and weightier. The same with arguments; to mistake, or even understate, an opponent's case, is the practice of the many respectable rogues controversy breeds; but it is more cunning than wise, for these are the known arts of falsehood, and truth gains nothing by them."

Now, I presume I may take for granted the permission to conduct my case according to my own judgment as to what is best under the conditions specified, and I claim the right to be calmly heard and fully understood before I am interrupted by attempts to draw me from my own line of argument, or am to be told that no more can be heard upon the subject, as soon as it is seen that the issue of the case is likely to be unfavourable to the professors.

I also wish it to be distinctly understood that I most respectfully decline to be treated as if on my defence, or to allow those to be my judges who have for 300 years proved themselves incapable of forming a correct opinion on the subject. In this discussion I occupy the position of plaintiff, and I place my opponents at the bar. I specifically charge them with having set aside a system of the most perfect cosmogony, which was designed by the Creator Himself, and never doubted or disputed by the profoundest philosophers of the first 5,000 years, and having placed in its stead a whimsical hypothesis and a baseless fiction, which the most learned professors of modern times have never pretended to explain, or ventured for one instant to defend. There is not a single fact to which any honest appeal can be made which has not given the lie to the globular theorists. In one of the papers of the *Mirror*, dated May 16, 1780, we read:—"In every art and science, practitioners complain how often they are deceived by specious theories and delusive speculation. Learned men, in the solitude of their studies, are apt to imagine that nothing they can reconcile to their own ideas upon paper can fail to be evinced by actual experiment, or to be reduced into easy and constant practice. But those who attempt to apply the doctrine to the fact too often find that what was infallible in the brain of the demonstrator is sadly fallacious in the hands of him who endeavours to illustrate it by an appeal to fact." Dr. Scott, writing on the Newtonian philosophy, soundly remarks, "I think it necessary to observe that the fallacy by which our celebrated philosopher imposed first on himself and afterwards on the world, proceeded from his having inconsiderately believed that there were powers in nature which do not exist, and, consequently, his conclusions, though formally and mathematically true, were materially and physically false; for nothing can be inferred from nonentity but nothing; and this was his case." This language exactly describes my charge against the doctrines of Sir Isaac Newton. If the earth is really the sphere his disciples contend for, it must have a demonstrable curvature on some part of its surface, either on land or water. Of this, Sir Isaac should have been positively certain before he wrote a single line of his "Principia." He simply delineated his figures according to the fictitious *data* of his predecessor, Kepler. But a structure can never have any permanent stability when erected on an insecure or disproportioned foundation. Sooner or later its weakness is sure to betray itself. And to persist in calling that a "globe" which practical measurements prove to be a plane may sound very scientific and learned, but it is shamefully at variance with the truth.

Newton's followers have blindly adhered to his teaching, but never have dared to justify it by an appeal to facts, or even to state the premises from which he set out. This is the dilemma in which I leave my opponents. I remain master of the situation till they can give me something more than mere assertion, or the frothy opinions of some of his learned dupes. In my next week's article I will describe the geometry of the circular plane and the extraordinary precision and harmony of the solar circuits, so that I trust every impartial and unprejudiced reader will be convinced that no human ingenuity, or skill, or conception could possibly have formulated or devised such a system, which the modern theorists have ruthlessly abandoned for the sake of the most irrational and fictitious conceit to which the mind of man ever was a slave.

It would greatly assist my explanation if the MS. diagram might appear with my next article. I have made it as simple as I possibly could, for fear of trespassing on the space afforded me.

JOHN HAMPDEN.

Mr. Hampden shall have weekly, for a reasonable time, from a column to a column and a-half (on the average), to explain his theory, with such illustrations as he may need. I accede to his request that he should be calmly heard without any comment or interruption whatever, provided he will, on his part, calmly explain his views without comment on those more generally accepted. If he proves his own, these last will of course be proved unworthy of credit. It may be well for Mr. Hampden to say how much space he will require to fully state and explain his views. If after that he should push himself off the board by wasting space in denunciation, he would not, I trust, blame KNOWLEDGE. He has not, as yet, got on very far with the statement of his views. With regard to Mr. Hampden's chart of the earth, to which he ascribes high pecuniary value, I can only say that I wish to publish nothing of his which he does not voluntarily offer.

R. P.

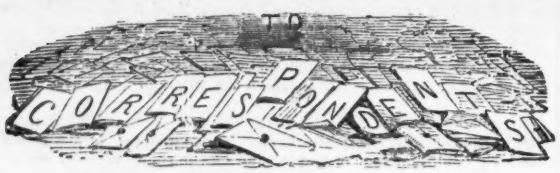
ACCORDING to a report by the Board of Trade on the Bills of the Session, there are 106 applications for provisional orders relating to electric lighting, the capital proposed being £2,752,778. According to the list of provisional orders originally applied for, there were 152 applicants. Comparing this with the Board's report, it will be seen that of this number 46 have allowed the matter to drop.

AT the Stanley Show of 1882, the National Arms Company of Birmingham exhibited a front-steering tricycle. This machine was distinguished by having a new double-driving arrangement, which consisted of two screws working on hook joints, the whole arrangement being contained in an oval gun-metal receptacle in the centre of the axle. The machine was admirably made, and commanded a great deal of attention and a good sale. Very recently it was announced that the National Arms Company were in liquidation. We are pleased to hear that a Limited Company has been formed for the purpose of carrying on the make of tricycles for which the late company had become celebrated.

NOT long ago there arrived in London in sound condition a large consignment of New Zealand mutton and beef. Full 24,000 legs and shoulders of the former were cast on the market one morning, yet the most searching inquiry among probable consumers of the Antipodean meat fails to elicit a trace of its ultimate destination as food. I have interrogated various butchers, but none of them have seen this meat, and all agree that their customers would never buy it. Some say that East-end butchers "clear" the market for a "low-price" trade; others opine that it goes to the suburbs, but all affect utter ignorance as to the precise way in which this mysterious meat has gone into consumption. It is a suspicious fact, certainly, that certain butchers who formerly had offal in abundance, are now innocent of such profitless accessories to the trade, and those who keep animals suffer great inconvenience. If it is gently hinted to one of these purveyors that Colonial carcases come without offal, and that this perhaps accounts for the present scarcity in some quarters of the special dainties of cat and dog, he turns virtuously indignant, and angrily repels any base and insulting insinuation on your part that possibly the key to the curious enigma may be found in Australian meat. There is an obvious wrong somewhere. Jesting aside, the enormous demand for butcher's meat in this country renders consignments like that of the *Sorato* a mere drop in the ocean. The unfortunate part of the matter is that so much Colonial meat is consumed by persons ignorant of its origin, that the popularization of Antipodean beef and mutton is, *pro tanto*, checked, and the public at large receives no benefit whatever from the importation of meat at 6d. or 7d. a pound. Now, it is well understood by those acquainted with the Colonial Pastoralists that directly they can distinctly see the way to a *general* popular demand in Great Britain for Colonial meat, the necessary organisation for sending a really adequate and regular supply will be forthcoming, and then, of course, the retailers will be compelled to sell at a reasonable profit and price. At present the butchers' hole-and-corner policy—equally selfish and shortsighted—is postponing the time when the seventy or eighty millions of Australian sheep will be really as much ours as though they fed in English pastures.

—P. R.

XUM



"Let Knowledge grow from more to more."—ALFRED TENNYSON.

Letters to the Editor.

Only a small proportion of Letters received can possibly be inserted. Correspondents must not be offended, therefore, should their letters not appear.

All Editorial communications should be addressed to the EDITOR OF KNOWLEDGE; *all Business communications to the* PUBLISHERS, *at the Office, 74, Great Queen-street, W.C.* IF THIS IS NOT ATTENDED TO, DELAYS ARISE FOR WHICH THE EDITOR IS NOT RESPONSIBLE.

All Remittances, Cheques, and Post Office Orders should be made payable to MESSRS. WYMAN & SONS.

The Editor is not responsible for the opinions of correspondents.

NO COMMUNICATIONS ARE ANSWERED BY POST, EVEN THOUGH STAMPED AND DIRECTED ENVELOPE BE ENCLOSED.

ON THE FORMATION OF COMETS' TAILS.

[747]—In the December number of the *Philosophical Magazine* for 1878, I propounded a theory to account for the repulsive force on the matter forming a comet's tail, which agrees in all essential respects with that published by Mr. Ranyard in KNOWLEDGE for Feb. 16, 1883.

The calculation of the repulsive force due to evaporation was there given for the first time. When I wrote my paper, I was not aware that the force arising from evaporation had been previously suggested as a possible explanation of the phenomenon, but in a letter received from Mr. Ranyard, shortly after my paper was published he informed me that at a meeting of the Royal Astronomical Society in 1874, he had said something on the subject of my paper, of which an account was given in the March number of the *Astronomical Register* for 1874, but he stated that he had not entered into a discussion of the magnitude of the force, as I had done, nor did he know of any evaluation of the accelerations which might be caused by evaporation, such as I had attempted. I was surprised therefore to find that in his paper, in which he is presumably putting forward original views, he enters into a discussion as to the adequacy of the force of evaporation to produce the repulsion observed, which, in so far as it is correct, is the same as that previously published by me.

The following is a quotation from my paper in which the same reasoning is employed as that given by Mr. Ranyard, though in a more complete and correct form :—

"In the first place the mass of a comet is so small, that the force of gravitation towards the centre on any of the bodies at some distance from the nucleus must be so small that it may be left out of consideration. We know that a molecule of matter in the gaseous condition has at ordinary and high temperatures a very quick motion of translation. A molecule, as it evaporates from the surface of one of the bodies composing the comet, must acquire a velocity relative to the body of several hundred yards per second. The body must, in consequence, suffer a recoil in an opposite direction to that in which the molecule escapes. Now, since the evaporation is caused by the sun's heat, it must take place chiefly on that side of the body which is exposed to the sun's rays. The resultant effect of all the small recoils due to the evaporation of the different molecules will therefore be to drive the body in a direction away from the sun. If the body has a motion of rotation, the whole surface might in turn become exposed to the sun's rays, and evaporation would probably take place even on the side turned away from the sun. But unless the body be of a regular shape, the effect of evaporation will be to gradually stop any rotation which it might at first have; for the force of recoil from the evaporation would act upon it in the same way as the wind does on a vane, and it would at length take up a position with its longest axis in the direction of the sun.

"Now let V be the average velocity relative to the body with which the molecules escape from it. Let M be the mass of the body just before the escape of a molecule of mass μ from it. Then the velocity due to the recoil as this molecule escapes will be $\frac{\mu}{m}V$. Now the molecules as they evaporate will start off in various directions, but almost always more or less towards the sun. Let us suppose, as being not far from the truth, that the inclination which their directions have to a straight line passing through the sun is on the average 45°; then the average velocity due to recoil acquired by the body on the evaporation of mass dm will be $\frac{dm}{m} \cdot \frac{V}{\sqrt{2}}$, and the velocity acquired while the mass of the body is being reduced by evaporation from m_1 to m_2 will be

$$\frac{V}{\sqrt{2}} \int_{m_2}^{m_1} \frac{dm}{m} = V \times 1{\cdot}63 \times \log_{10} \frac{m_1}{m_2}.$$

Now the average velocity of hydrogen molecules at 0° C. is 1·06, of oxygen ·266, and of water vapour ·35 mile per second. For the sake of illustration, let us suppose that V = ·35, and $\frac{m_1}{m_2} = 1000000$, these being the values we should have to assign if the body were block of ice containing one gramme of sand or any other non-volatile substance, the block itself being equal in mass to a cubic metre of water. The velocity due to recoil by evaporation would then be 3·42 miles per second, or about 295,000 miles per day. A tail would thus be formed which would increase in length nearly a million miles in every three days. The visible portion of this tail would consist of solid or liquid matter which had resisted evaporation; but there would also be present in the tail a large portion of the gas formed during evaporation; for since the evaporating gas has a velocity relative to the body from which it is evaporating of ·35 mile per second, those portions of the gas which have evaporated since the body acquired by recoil a velocity greater than ·35 mile per second will be also carried backwards into the tail. The estimate of the rapidity of tail-formation I have just made has been made on the supposition that the temperature of the escaping gas is 0° C. If the absolute temperature in Centigrade units of the gas be t, we must multiply the above estimate by $\sqrt{\frac{t}{273}}$. Now, in no case has the rapidity of tail-formation greatly exceeded one million miles in three days, except in the case of those comets which have approached very near to the sun, and where, consequently, the temperature at which the evaporation has taken place must have been very great."

The expression given by Mr. Ranyard for the velocity of the evaporating body, or particle, after half its substance has evaporated, is $\frac{V}{1{\cdot}42}$, *i.e.* $\frac{V}{\sqrt{2}}$.

It will be see from my formula given above, that putting $\frac{m_1}{m_2} = 2$, the correct expression is $\frac{V}{\sqrt{2}} \times$ Nap. log 2, or $\frac{V}{\sqrt{2}} \times {\cdot}693$.

Mr. Ranyard has apparently assumed that the effect of the successive evaporations of the different particles would be the same as if all the particles had parted from the evaporating body at the same moment; but this would not so, for in the latter case all the evaporating particles would acquire a velocity, V, relative to the evaporating body, and, therefore, also relative to the general mass of the comet, whilst in the former case the particles evaporating after the body had acquired a backward motion, though they would still have a velocity, V, relative to the body, would have a different velocity relative to the general mass of the comet. The momentum produced in the unevaporated portion being in both cases equal and opposite to the resultant of the momenta of all the evaporated particles, must be less in one case than in the other.

There are some other considerations relating to this evaporation theory which I hope to be allowed to lay before your readers in some future number of KNOWLEDGE; but I must not now trespass further on your space. ARTHUR S. DAVIS.

Cheltenham College.

PURIFYING GAS. (?)

[748]—A correspondent referring to the statement in KNOWLEDGE, No. 67, of February 9, 1883, page 85, 1st col., 2nd par, regarding the Albo-Carbon Light Co., that each "Burner is accompanied with a means for *purifying*," &c., writes as follows :—

"As a gasman who has been in communication with their agent, allow me to say that the essence of the patent is the addition of something, say naphthaline, to the gas in transit from the service-pipe to the burner, whereby the illuminating power is slightly increased. The something in question does not contain any chemical absorbent capable of catching any impurity, say ammonia, or sulphur, or carbonic acid; and it is not necessary, as the gas is tested daily, and often by a chemist duly appointed, and whose certificate, no doubt, is to be had in pursuance of Act of Parlia-

ment. It is common to hear the sellers of burners and regulators, and sometimes glasses, say that their goods act by purifying and improving the gas.

THE WEATHER FORECASTS.

[749]—The observations quoted in this week's KNOWLEDGE fully bear out those that I have been mentally taking at various times during different times of the year, and all alike tend to show the absolute absurdity and uselessness of the Weather Forecasts that appear day after day in the newspapers. It is briefly nothing more or less than a "farce." As a rule, the forecast given is vague in the extreme, and might cover any weather that might naturally be expected to follow the weather at the time the forecast was made, and I have noticed that on *no single occasion has any sudden and startling change in the weather been announced in clear and unmistakable terms.*

The *great changes*, consisting of the incidence of various of the great and disastrous storms of last year, were covered by the usual inane and vague announcement, but never once did the forecast tell us in plain language that a direct change was coming. On the *day following* any marked change of weather, *then* we see the forecast, following the existing weather.

Everybody who knows the state of the conditions regulating our insular climate must well know the impossibility of ever being able to foretell the weather for even an hour, and, therefore, it seems an outrage to common sense (and the national purse) to see the large sums of money spent in such an absurd and impracticable undertaking as to attempt to foretell the weather.

At the seaside it is as often as not that the people concerned laugh at the ostentatious hoisting of the cones and drums, unless they can see with their own eyes and realise from their own sensations that there is bad weather brewing.

The Meteorological Office is nothing more nor less than a waste of public money. ANOTHER OBSERVER.

LETTERS RECEIVED.

G. R. Wynne—T. Quilliam—E. W. P.—John Fae—J. Gray—L. Hargrave—A. W. W.—F. H.—F. C. Green—A. W.—B. T.—C. E. Johns—T. C.—E. Wilkins—W. Pilgrims—J. A. Gee—J. Millard—F. Dakin Rudkin—H. H.—M. G.—T. D. Nicholson—J. H.—H. A. B.—M.—Junius—J. S. Pope—T. D. Lewis—A. H. Smith—W. Hadingham—W. H. S. Monck—S. Skinner—Williams—Carlton—T. Ward—Russell Spoker—Veritas (utterly decline to do anything of the sort; by his foul abuse of Spencer and Darwin the man has deprived himself of all right to consideration; what you refer to is a fact, though your friends may *not* have heard of it).

IT is reported that an electric exhibition is to be held in Spain this year, and will open on Dec. 21 next. The locality is not mentioned. An electric exhibition is to be held in Königsberg, in Prussia, and will open on April 15.

AT a recent meeting of the City Commission of Sewers, the award of the arbitrator appointed by the Board of Trade with reference to the ventilation of the Metropolitan District Railway was presented. Captain Galton had decided that there should be one opening in Queen Victoria-street, near Bennett's-hill, 50 ft. long by 6 ft. 4 in. wide, and another opposite the steps into Lower Thames-street, 23 ft. by 3 ft. 10 in., each with balustrades 8 ft. high.

PHILADELPHIA derives an annual revenue of £2,400 from telegraph, telephone, and electric light companies, for the use of its overhead and underground wires. Each company makes a return annually of the number of poles, &c., and a payment of £1 per annum for each mile of wire used for telegraph or telephone purposes, and £3 per mile per annum for electric lighting purposes is required. There are at present about 10,000 miles of wire in the city.

A FREE SMOKE ABATEMENT MUSEUM.—The National Smoke Abatement Institution is making arrangements for opening a permanent exhibition in a central part of London, in an extensive range of buildings, for the display of apparatus, fuels, and systems of heating, combining economy with the prevention of smoke, and the best methods of ventilating and lighting. The exhibition will be free to the public, and will include examples of all the most recent inventions and improved apparatus. A lecture hall, for the reading of papers and instruction classes, will be provided; also testing rooms, under the supervision of experts, for the purpose of continuing the series of tests and trials commenced in connection with the South Kensington and Manchester Smoke Abatement Exhibitions of 1882. Particulars may be obtained at the offices of the National Smoke Abatement Institution, 44, Berners-street, Oxford-street, London, W.

Our Whist Column.

BY "FIVE OF CLUBS."

TRUMP-PLAYING—(*continued from* p. 139).

BUT suppose that numerically you and your partner have slightly the advantage over your opponents in trumps—that one of you has four, the other three; the opponents each having three.

Trumps lying thus, with, perhaps, the best honours with the enemy, every round in trumps which you or your partner may take out, if there has been no ruffing, increases your relative strength in trumps, and the third leaves one of you with the long trump. But even if you knew from the beginning exactly how the strength in trumps lay, it by no means follows that your relative strength in the hand would be increased by a process thus leaving you with the command in trumps. On the contrary, if neither you nor your partner have a suit which you can establish, while the enemy, well protected in your suits, have—either of them—a long suit, of which between them they can get the entire command, your long trump, though it must make, will profit you little. It will be forced out, and a winning card in one of your suits (if you have two long suits) will bring the enemy in again, when their long suit will come in effectively.

In such a case, it is idle to attempt a forward game merely because you perhaps find after a few rounds that you have numerical superiority in trumps. You may play, if you see a fit opening, the same sort of game as if you were both weak in trumps—especially if each of the adversaries shows a long suit. Your long trump cannot do more than make one trick in this case; it cannot bring in a long suit. You may then, without fear of loss, either ruff with one of four trumps when you get the chance, or force your partner, though holding three, and knowing or suspecting that he holds four. Should you succeed in establishing a cross ruff, you gain by this policy, and even if you fail, you lose nothing. Holding on to the hard and fast rule, Pass a doubtful card if numerically strong in trumps, is unwise in such a case as this—which is of frequent occurrence, be it noticed. Often enough the only chance of saving the game lies in ruffing freely while you can. The enemy—if they know what is good for them—will stop that game fast enough when they get the chance, showly clearly that it is your best policy, despite the book rule so often quoted. Your chance comes while they are waiting till one or other has established his suit. This they will only do so long as your all-round weakness has not been disclosed; you must seize the opportunity, and make your tricks while you can.

Suppose, for instance, *A* holds Knave and three small Spades (the trump card being the Ace of Spades, *Z* the dealer), King and three small Hearts, three small Clubs, and two small Diamonds; while *B* holds Queen and two small spades, Knave and two small Hearts, two small Clubs, and four small Diamonds. *A* leads a small Heart, which *Z* takes with the Queen, leading Ace of Clubs and following with a small Club. His partner, winning this trick with the King, leads, let us say, Diamond seven, which his partner takes with the Queen, returning the Ace, to which *X* drops, a three, showing that he had led the penultimate. Suppose now that *Z* continues with a small Diamond. Shall *A*, holding four small trumps, refrain from trumping? It is clear that *X Z* are protected in Hearts, and each had originally a five-card suit. *B* has not signalled, and neither of the enemy has led trumps. The chances are, then, that trumps are pretty equally divided, but with the Ace in *Z*'s hand the odds are in favour of *X Z* holding the commanding cards. Under these circumstances, the best policy seems to be, not to try to fight against two strong suits with one long trump, and that not certain, but to trump the doubtful Diamond led by *Z*. This is probably giving up all chance of getting the command in trumps; but it is taking the best chance of what seems the best hope—a cross-ruff. After taking the trick thus by ruffing, *A* should lead a small Club, giving up his own suit, of which he knows that the enemy holds the King card (so that getting in they would probably lead trumps). This *B* ruffs, and leads a Diamond, which *A* would ruff, unless *Z* at once stopped the cross-ruff by putting on his trump Ace, which he would not be apt to do over his partner's suit. The remaining tricks would probably go to *XZ*, but three having been made by *AB*, the game—the score being supposed at "love all"—would be saved; whereas if *A* had refrained from ruffing, and then forcing *B*, it must have been lost.

(*To be continued.*)

INTERNATIONAL SCIENTIFIC SERIES.—NOTICE.—The New Volume in the above Series, entitled ELEMENTARY METEOROLOGY, by ROBERT H. SCOTT, Secretary to the Meteorological Council, is Now Ready, with Numerous Illustrations, crown 8vo, cloth, price 5s.

London: KEGAN PAUL, TRENCH, & CO.

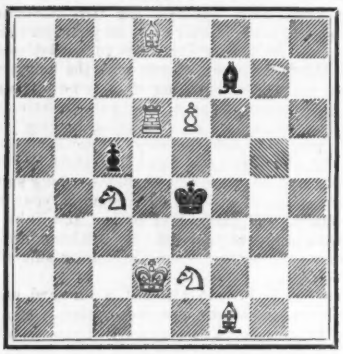
Our Chess Column.

By MEPHISTO.

PROBLEM No. 78.

By JOHN SIMPSON.

BLACK.



WHITE.

White to play and mate in three moves.

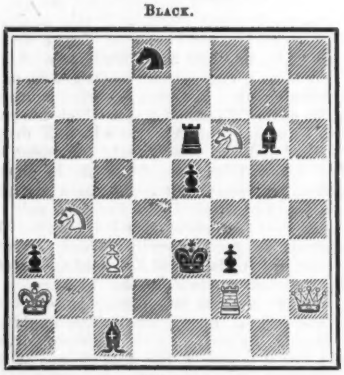
Fakenham, 20*th Feb.*, 1883.

Dear Sir,—I enclose a problem for insertion as a reprint in KNOWLEDGE. It has a curious history. It was published in the *Illustrated London News* in 1854, and the solution printed therein was *not* the author's; and, curiously enough, he did not look at the solution at the time, and has only lately learnt from me that the problem has *two* solutions, both of which are very pretty. You will see that Mr. Grimshaw's embodies the idea (so much talked of) of Healey's Bristol Three-mover, which was not published till *six years later* than Mr. Grimshaw's. I have been in correspondence with Mr. G. about it, and have his leave to send it to you with enunciation as given. J. A. MILES.

PROBLEM No. 79.

By WALTER GRIMSHAW.

BLACK.



WHITE.

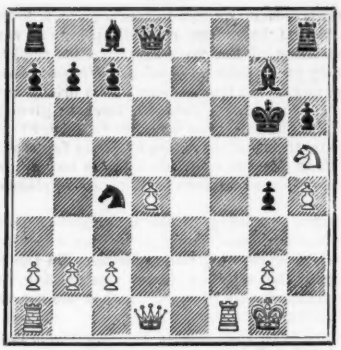
White to play and mate in four moves two entirely different ways.

We are much obliged to Mr. Miles for sending us this Problem, which, apart from the curious history of its double solution, is remarkable for the difficulty of the author's solution. We feel some compunction, and will not impose upon our readers the hard task of finding the two solutions; we will assist them by giving the first move of each solution, which are:—For the author's solution, 1. R to QB2, threatening mate by Q to R6; for the second solution, 1. Kt (B6) to Q5 (ch).

The following position is the result of a variation in the Allgaier Gambit, where the black Queen's Knight, after taking the white Queen's Bishop on K5, is allowed also to take the King's Bishop on QB4. This termination has occurred to us several times; also in a game played last week. We hope its publication as an ending will make our readers careful of the danger to be guarded against. White proceeded as follows:—

AMATEUR.

BLACK.



WHITE.

MEPHISTO.

Q to Q3 (ch)	K takes Kt
R to B5 (ch)	B takes R (best)

(If K to Kt3, then R to Kt5 (disc. ch), K to B2. Q to Kt6 (ch), K to K2. R to K sq (ch), B to K4 (best). R (Kt 5) takes B (ch), Kt takes R. Q to Kt7 (ch), K to K3 (best). R takes Kt (ch), K to Q3. Q to Kt6 (ch), and mates in three moves.)

Q takes B (ch)	K takes P

(Black ought to play Q to Kt4! which would make the game rather difficult for White.)

P to Kt3 (ch)!	K to R6
Q to B sq (ch)	K takes P
Q to B2 (ch)	K to R6
Q to R2 mate.	

SOLUTION.

PROBLEM No. 77, p. 124, BY T. W. COMBE.

1. K to Kt6	1. K takes Kt, or K to K5
2. Q to B6, mate.	

ANSWERS TO CORRESPONDENTS.

*** *Please address Chess Editor.*

G. E. Thompson.—Thanks for communication.

H. Nuttall.—No. 77, 1. Q to Q7 (ch), K to K5, and there is no mate.

CLARENCE.—Thanks for problems. What is the deceased author's name? If one piece, say a Queen, could give mate by checking on different squares, this would be considered a *dual* in a problem.

C. B.—Sorry we do not know. Perhaps Jacques, in Hatton-garden, may have some pattern-books.

SCHMUCKE.—H. A. D. Solutions correct.

Correct solutions of Problem No. 77 received from W., G. Swedenbank, C. C., G. E. Thompson, I. G. Powell, J. S. Maskery, T. Evelyn, E. Ridgeway, R. S. Standen.

NOTICES.

Volume II., comprising the numbers published from June to December 1882, price 8s. 6d

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